PATRICK LAKE WATERSHED MANAGEMENT PLAN

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PROCEDURE FOR MODIFYING LAKE MANAGEMENT PLAN

The Patrick Lake District will maintain an agenda item of "modifying lake management plan" on its meeting notices. Although suggested changes or additions can be presented at any time, they will only be acted upon at the annual meeting. It is anticipated that the Lake Advisory Group will continue to function as a research and advisory group for the Lake District. One member of the Lake District Board will be appointed to chair the Lake Advisory Group.

BASELINE INFORMATION

Patrick Lake is located in the Town of New Chester, in Adams County, Wisconsin. This natural seepage lake has 50 surface acres, with a maximum depth of about 17', when at its normal lake level. It is located near the top of the escarpment that runs through Adams County from northeast to southwest. Water from this lake eventually flows into the Fox River, then Lake Michigan. In the past few years, the lake level has been steadily dropping, to the point that most docks are no longer in the water.

There are no surface inlets or outlets. The lake is fed by springs, groundwater and surface runoff. A 1985 study indicated that groundwater flow was on a west to east gradient, with groundwater flowing out of the lake except at the northwestern end of the lake. Thus, according to the 1985 study, the lake is fed mostly by precipitation (52%) and surface runoff (32%), with only about 16% of the inflow from groundwater. Outflow from the lake was about evenly divided between groundwater (51%) and evaporation (49%).

A Lake District was formed in 1981. Several studies/plans were completed at the request of the lake district in 1983, 1985 and 1995.

Watershed Land Use

In 1985, surface watershed land use was estimated at 48% woodlands, 11% residential, and 5% agricultural, with the remaining 36% being lake surface area (water). However, a 2004 evaluation of the primary land uses in the surface watershed of Patrick Lake found that the most common land use was residential (56%). The most common use was woodlands (30.3%%), followed by non-irrigated agriculture (2.1%) and water (1.6%). Development over these twenty years has likely changed the land

use impacts—science suggests that increased development is more likely to negatively impact water quality than agriculture or woodland use.

The ground watershed has a substantially different ratio of land uses. Primary use in the ground watershed is irrigated agriculture (45.41%), followed by woodlands (31.63%). Residential land accounts for 12.4% of the ground watershed. Minimal uses are water (9.7%) and non-irrigated agriculture (1.07%).

A county park is located on Patrick Lake with a sand beach and a public boat access. There are also softball playing fields in the park. The boat ramp currently gets little use, due to the low lake levels.

Soils in the Watershed

Soils in the ground watershed range are all sand or loamy sand, with slopes from totally flat to up to 20%. Dominant soil type is Sand (55.93%). The rest of the soil is Loamy Sand (38.7%). The remaining 5.37% is water.

Soils in the surface watershed are substantially the same: Sand (47.37%) and Loamy Sand (42.94%). There is a little muck (.35%). 9.74% of the surface watershed is water.

The sand and loamy sand soils tend to be somewhat excessively drained, with rapid permeability in the surface layer and rapid permeability in the subsurface layers. Land runoff is minimal because of the high infiltration rate of sand and loamy sand. Available water capacity ranges tends to be low, as is natural fertility. Organic matter content is also low, except in the muck soils. There are wide ranges of suitability for cropping, tree-production and engineering uses. Most of these soils have erosion, blowing and drought hazards as well. Depth to groundwater is mostly over 20', although there are some areas of perched water tables. Bedrock is mostly sandstone.

Lake Morphometry

Patrick Lake has three "lobes". Deepest water is found in the middle lobe, with the far east and far west lobes being no deeper than 10' at usual lake levels. There are broad gradual littoral zones. All of the lake bottom is populated by aquatic plants.

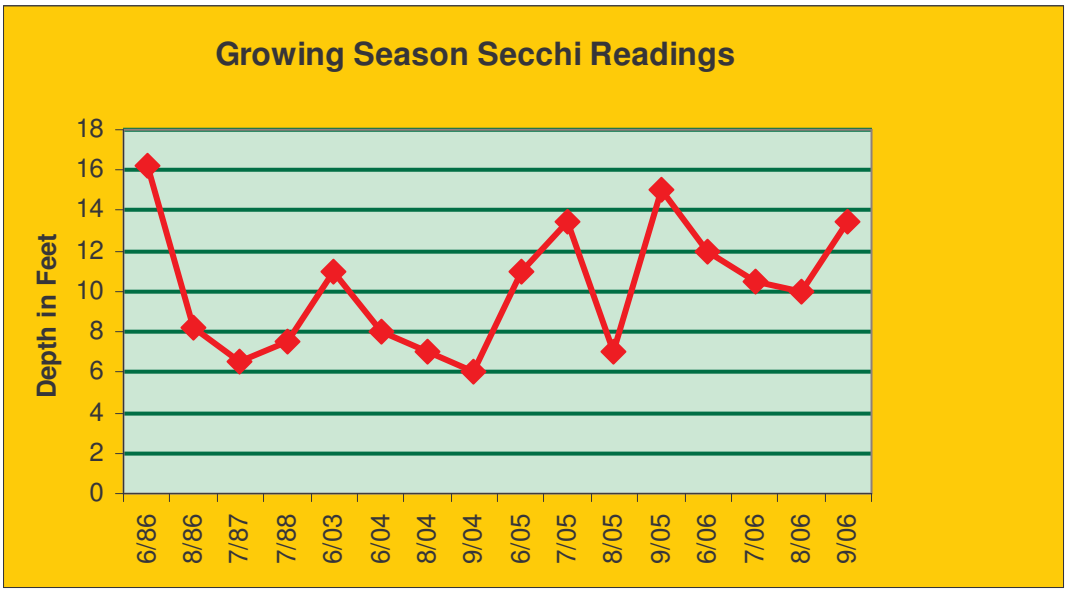
Sediment composition of the lake bottom includes sand, silt, muck and peat, or combinations thereof. The dominant sediment was pea (30% overall), especially at depths over 5'. Silt/peat mixtures dominated the 1.5'-5' depth zone (23% overall). Both sand (13% overall) and silt (15% overall) were common in the shallow depths.

Historically, maximum water depth has varied greatly, from 21' in the 1930's, down to 10' in the late 1970's, then up to 25' in 1983. A study of the lake done in 1982-1983 indicated that much of the original lake depth had been filled in with sediment and estimated that the original lake volume had been reduced by 2/3.

Lake Chemistry

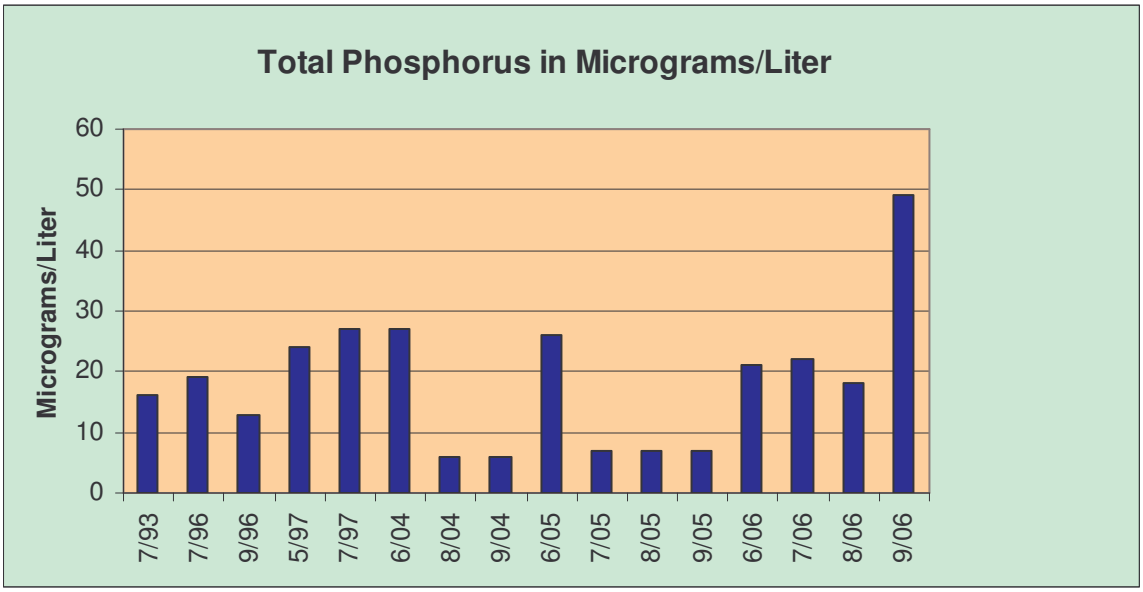
The 1985 report indicated that most of the phosphorus addition to the lake resulted from surface runoff and precipitation. Using various trophic models and water chemistry information available at the time, the lake was determined at that time to be a meso-eutrophic lake. As noted below, the lake has improved in trophic status to being a oligo-mesotrophic lake.

The most recent readings taken in Patrick Lake show that it is a moderately hard lake. The water has good transparency (as it did in 1985). Secchi disk readings taken 2003-2005 in the growing season have averaged 10.4'. This places Patrick Lake in "oligotrophic" lake status, with good to very good water clarity. "Oligotrophic" lakes are those with clear water and low productivity. They may have large game fish.

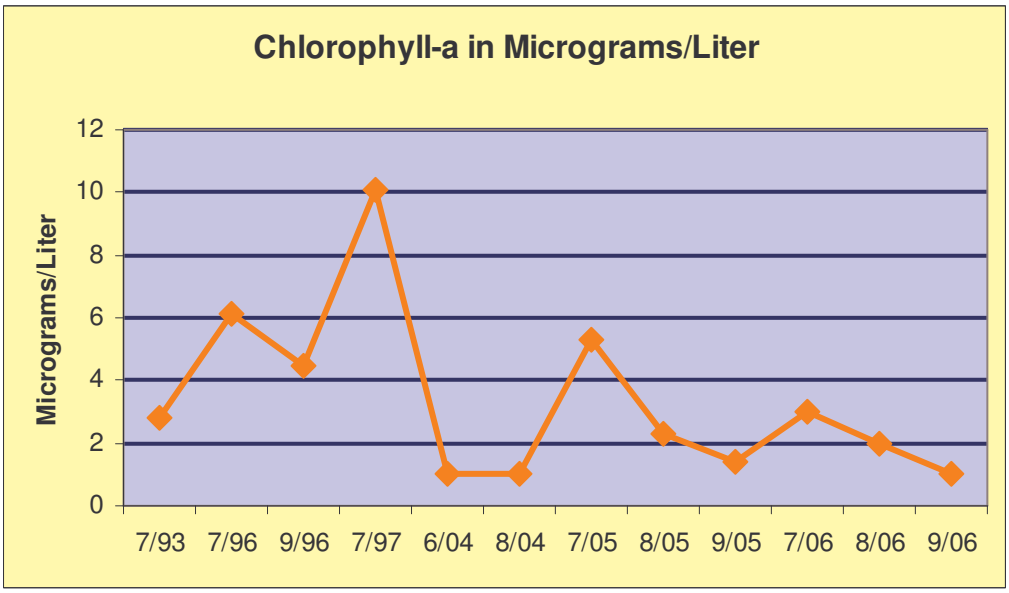


Another way of roughly measuring water quality is the total phosphorus readings. The Adams County Land & Water Conservation Department gathered historical phosphorus readings from the DNR and from the Self-Help Monitoring Records. It has also conducted several tests of its own in 2003 and 2005. Currently, the average total phosphorus reading (2003 to 2005) is 14.36 mg/l. Except for one spike in September 2006, total phosphorus readings for the growing season in the top of the water column has been below 30 micrograms/liter. This places Patrick Lake again in the "mesotrophic" class and is an above-average reading for a natural lake (average is 30 ug/l), indicative of good to very good water quality. "Mesotrophic" lakes tend to have accumulated organic matter and increased productive, with occasional algal blooms and good fishery. Even the deeper depths of Patrick Lake

tend to have total phosphorus readings below 30 ug/l (except again a spike in September 2006).



Chlorophyll a is the third result often used in evaluating water quality. This pigment has been found to be correlated with algal bloom frequency. Patrick Lake's average chlorophyll a reading for 2003-2005 was 2.01 mg/l. An average reading of 1 to 5 mg/l places a lake in the "oligotrophic" class.



The waters of Patrick Lake tend to be fairly neutral, with pH readings running from 6.29 to 8.32 (7.0 is neutral). The alkalinity level (100 mg/l) provides Patrick Lake with sufficient alkalinity to protect its fishery from the effects of acid rain or other acidic deposits.

Readings for sodium, chloride, magnesium, sulfate and potassium in Patrick's waters have all been low, below any caution levels. Most of the turbidity results have been elevated over 1 NTU, suggesting that drinking water out of Patrick Lake may not be safe.

Aquatic Plants

Patrick Lake is a mesotrophic to oligotrophic lake with a long history of heavy aquatic plant growth and abundant, sometimes dense, algal growth. DNR records show complaints about aquatic plant and algae growth as far back as June 1978, when weed density was described as "heavy", with 100% of the lake vegetated.

Part of the 1985 study included an aquatic plant survey. That survey found 15 species of aquatic plants. The most common species were pondweeds (*Potamogetons*) and naiad (*Najas*). Floating-leaf plants were found in small proportions in a few areas of the lake.

An aquatic plant survey was conducted again in July 2005 by staff of the Wisconsin DNR and Adams County LWCD. That survey found 17 species of aquatic growth, with 100% of the sample sites vegetated. Southern Naiad *(Najas guadelupensis)* had the highest overall frequency, was the overall dominant species, and also had an above average density of growth. Other aquatic species showing common frequency and/or high density included White water lily (*Nymphaea odorata*), Illinois pondweed *(Potamogeton illinoensis)*, and Clasping-leaf pondweed (*Potamogeton richardsonii*). The plant-like algae, *Chara*, was sub-dominant. Plant maps for the three structure types found—emergent, rooted floating-leaf and submergent—are shown below.

Overall, 3 of the species found were emergent species, 3 were floating-leaf and 12 were submergent. The latter includes Eurasian watermilfoil (*Myriophyllum spicatum*). Filamentous algae was found at 36% of the sample sites.

Treatment histories show that the lake district has generally attempted to manage aquatic plant growth by chemical treatments, although it does have an old harvester that it has used infrequently. In 1958-1959, 2300 pounds of sodium arsenite was put into the lake. 450 pounds of hydrothol (an endothall product) was put in the lake in 1979. In 1980-1981, diquat (7 gallons) and cutrine (4 gallons) (containing copper) were used. In 1983 and 2005, 2-4 D was used for a total of 1875 pounds.

Some of these chemicals, including the arsenic and copper, now reside in the sediments of Patrick Lake.

The 2006 report suggests that the following: (1) that all lake residents practice best management practices on their lakefront property, including keeping septic systems cleaned & properly functioning, using no lawn fertilizers, cleaning up pet wastes, and no yard wastes into the lake; (2) that lake residents resume involvement in the Volunteer Lake Monitoring Program to track seasonal and year-to-year water quality changes; (3) that sensitive areas be designated in the lake to protect areas most important for habitat and water quality (this will be completed in 2006); (4) that lake residents install native plant buffers at the shoreline to provide habitat and protect water quality in the lake; (5) that all lake users protect the aquatic plant community; (6) that the lake district maintain exotic species signs at the boat landings to educate lake users; (7) that the lake district continue monitoring Eurasian watermilfoil, continuing early-season treatments for larger areas and hand-pulling scattered plants and small colonies.

Emergent Plants in Patrick Lake

RE:2/07

Emergent Plants Found

Floating-Leaf Plants in Patrick Lake

RE:2/07

Floating-Leaf Plants Found

Submergent Vegetation in Patrick Lake

RE:2/07

Aquatic Vegetation Found 2005

Fishery

Patrick Lake has a diverse fishery, including largemouth bass, northern pike, and many panfish. Stocking records go back to the 1960s. There is a long history of fish kills dating back to 1936 and many reports of stunted panfish. In 1962, there was a

chemical kill of all fish in the lake. At that time, small yellow perch, black bullheads and bluegills were found. No bass or pike were found at that time, so they were stocked in 1963.

An aeration system installed in 1974 improved the oxygen levels to the point that winterkills have been greatly reduced.

Shoreline Use

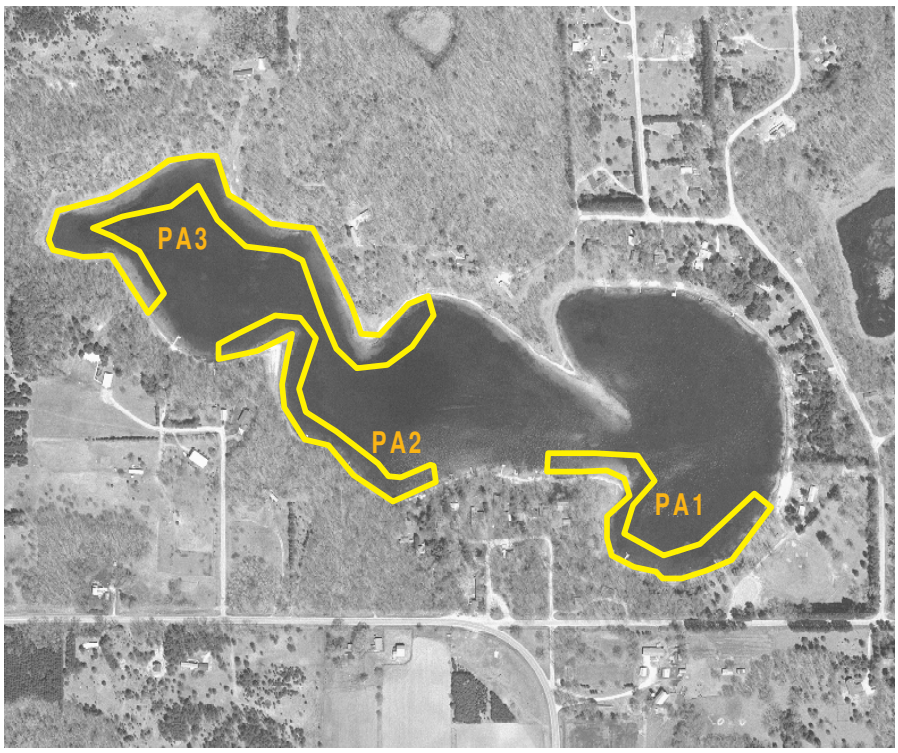
During the 2005 aquatic plant survey, a survey of the shoreline was also conducted. Herbaceous plants were found at all sample sites. Wooded plants were found at 27% of the sites and shrubs at 33% of the sites. Native plants thus covered about 80% of the shoreline. Overall, disturbed shore covered 20% of the shore. Traditional lawn was found at 40% of the sites, with 17% coverage. Hard structures were found at 27% of the sites, with 3% coverage. Disturbed shoreline has been found to contribute negatively to water quality.

Critical Habitat Areas

Under Wisconsin Rule 107.05(3)(i)(I), the Wisconsin DNR can evaluate a lake and declare particular areas of the lake as "critical habitat areas." These are defined as "areas of aquatic vegetation offering critical or unique fish & wildlife habitat or offering water quality or erosion control benefits to the body of water."

Critical habitat areas for Patrick Lake were determined in 2006 by staff from the WDNR and the Adams County Land & Water Conservation Department and are shown on the map on the next page.

PA1 extends along approximately 800 feet of the shoreline. Sediment includes muck and silt. 70% of the shore is native herbaceous vegetation; 23.3% of the shore is cultivated lawn; the remaining shore is hard structure. There are downed logs in the water that provide fish and wildlife cover. Filamentous algae were found in this area. There is a moderate level of human disturbance at this area. PA2 extends along approximately 1000 feet of the shoreline. Sediment includes peat, sand, silt and mixtures thereof. 25% of the shore is wooded; 10% has shrubs; 45% is native herbaceous cover. The remaining shore is cultivated lawn and hard structure. Large woody cover is common in the shallow water for habitat. PA3 extends along approximately 1650 feet of the shoreline. Sediment includes marl, muck, peat, sand, silt and mixtures thereof. 6.7% of the shore is wooded; 5% has shrubs; 85% is native herbaceous cover—the remaining is cultivated lawn. Large woody cover is present in shallow water for fish and wildlife cover. Scenic beauty in part of the area is lessened due to the human development.



RE:6/06 **Patrick Lake--Critical Habitat Areas**

Wildlife and Endangered/Threatened Resources/Cultural Resources

No threatened or endangered resources have been reported in the watersheds of Patrick Lake. No archeological sites are known, according to the Wisconsin Historical Society.

Prior Studies/Evaluations

A 1983 evaluation of the lake was conducted by a private organization. This study looked at groundwater flow & content, soil analysis, lake level, lake water chemistry, sediment composition and aquatic plants. Several recommendations were contained in the "Conclusions" section: (1) mechanical plant harvesting and chemical treatment for continued recreational use; (2) limitations on large or high speed boats and waterskiing-type activities; (3) reduction of nutrient input to the extent that it was economically feasible.

The 1985 study mentioned previously also made several recommendation for lake management: (1) minimizing nutrient loading & sedimentation to the lake via surface runoff, soil loss and groundwater; (2) installation of shore buffer zones a minimum of 20' back from the water to control nutrient/sediment input from overland

flow of stormwater; (3) raking of fallen leaves to prevent them from entering the water & adding nutrients through decomposition; (4) management of stormwater runoff upslope; (5) minimization of impervious areas like driveways or patios; (6) reduction in use of lawn fertilizers; (7) voluntary management & maintenance of private wastewater disposal systems around the lake; (8) development of a regular water monitoring program, including involvement of lake residents in the WDNR Self-Help Monitoring Program; (9) limitations on motorized activities on the lake, especially those that add pollution and/or result in high wave action that increases erosion & water turbidity; (10) implementation of a selective mechanical plant harvesting plan with a larger & more efficient harvester; (11) use of chemicals to control aquatic plants only when there is no other alternative.

There was also a study conducted in 1995 by a private concern with recommendations for a lake management plan. These recommendations included: (1) minimize nutrient input into the lake; (2) leaving buffer strip along lakeshore & roads to catch nutrient & sediment loads before entering the lake; (3) collection of litter (including yard waste) in yards & along roads; (4) modifying agricultural practices in the watershed to reduce nutrient loading; (5) use of best management practices on lakefront lots such as grassed waterways & vegetative stabilization; (6) routine inspection of private waste systems; (7) evaluating land uses every 5 years & adjusting plans accordingly; (8) regular water monitoring & sampling, including water samples at two depths, several times per year; (9) implementation of an aquatic plant management plan using mechanical harvesting & herbicides; (10) use of chemical for plant control only when other practices are impossible or impractical; (11) practicing catch & release of bass & northern pike to encourage control of historically-stunted panfish & bring panfish population back into balance; (12) long-term monitoring of lake water levels; (13) implementation of recreational use controls such as limiting motor boating hours, establishing no-wake zones and limiting boat motor size or type.